

seconds. The millimeters of axial length can be determined by using tables that take into account the speed of sound transmission in aqueous, vitreous and the lens. A-scan units having digital read-out screens are much easier and quicker to use, although the accuracy of both methods is comparable.

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Major Ocular Trauma

OCULAR TRAUMA remains one of the leading causes of blindness, particularly in younger persons. The results of treatment of injuries to the anterior structures of the eye have improved dramatically primarily because of the use of microsurgical techniques and postoperative topical steroids. However, injuries involving the posterior portion of the eye, such as the vitreous and retina, continue to have a poor prognosis because of the high incidence of retinal detachment.

A posterior penetrating eye injury is often complicated by vitreous hemorrhage, which is a potent stimulus to inflammation. The reparative process is characterized by proliferation of fibroblasts and, as in other parts of the body, contractile myofibroblasts, which are cells with smooth-muscle characteristics. While this repair process is beneficial for the skin and other organs, it can be harmful to the eye, primarily because of the anatomical relationship of the vitreous and retina anteriorly. The myofibroblasts use condensations of the incarcerated vitreous as a scaffold to form transvitreal and epiretinal membranes, which later contract and cause traction on the retina, eventually leading to traction retinal detachment.

With pars plana vitrectomy, this proliferative process may be interrupted and many cases, previously considered inoperable, can now be salvaged. Vitrectomy is carried out using a small cutting and sucking instrument of less than 1 mm in diameter that is introduced into the vitreous cavity just anterior to the retina. An infusion of physiological solution maintains the intraocular volume and, thus, complex manipulations inside the eye are possible.

Penetrating ocular injuries must be repaired promptly. If the presence of an intraocular foreign body is suspected preoperatively, it must be identified using x-ray studies and then localized by

computerized tomography (CT scan) or ultrasonography. At the time of primary repair, corneal and scleral lacerations are sutured, using microsurgical techniques. A severely disrupted lens may be removed at the same time, but if the injury involves the posterior ocular structures, the ophthalmologist should confine the primary repair to meticulous surgical wound cleansing and precise closure. An extensive posterior vitrectomy is delayed until the time of the second reconstruction, some 7 to 10 days after injury. By this time, the risk of intraocular bleeding has lessened and alterations in vitreous anatomy make vitrectomy technically easier.

The surgical objectives at this stage are to remove opacities such as vitreous hemorrhage or a cataractous lens, to peel and segment vitreous traction membranes, to remove nonmagnetic or impacted intraocular foreign bodies and to identify and treat retinal holes or detachment. If the retina is detached, the infused fluid in the vitreous cavity may be exchanged with air or a sulfur hexafluoride (SF₆) gas/air mixture to provide an effective retinal tamponade.

Vitrectomy has become an established mode of treatment for severe ocular injuries. While primary repair remains the domain of a general ophthalmologist, vitrectomy is a time-consuming operation, requiring complex instrumentation and experienced personnel and is best done in a center with special expertise in vitreous procedures.

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Danger With Eyedrops

EYE SOLUTIONS, suspensions and ointments are the most common methods of delivering medication to the conjunctiva, cornea and anterior chamber. These medications range from simple decongestants to potent antimicrobial or corticosteroid drugs. Eyedrops can be crucial in the treatment of serious eye disease; however, their misuse can be harmful to the eyes.

For proper administration of eyedrops, the patient should look up with the head tilted back slightly. When the lower lid is pulled away from the eyeball, the drop is placed inside the lower lid and the patient is advised to blink gently *without* squeezing the lids closed. The patient should blot

away only that medication which runs out of the eye, and maximum absorption is thus achieved. The tip of the dropper should not touch the eye or lids.

Simple decongestant drops are widely used because the medication is available without prescription. Occasional use for itching, burning eyes is acceptable, but routine use is to be discouraged because rebound hyperemia and sensitivity reactions to the medication or preservative may result.

Antimicrobial (for example, bacterial, viral or fungal) medications should be ordered only when clearly indicated. These drops are given for infection and, in cases of severe conjunctivitis or corneal infection, sometimes must be administered as often as every hour, on a 24-hour basis. Toxic and hypersensitivity reactions are common.

Corticosteroid eyedrops can be critical in treating ocular inflammations such as iritis. These drops can cause devastating eye disease, however, such as blinding glaucoma and cataracts. Steroids also can facilitate the development of viral, bacterial or fungal corneal disease. Because the damage done by treatment with corticosteroids can far outweigh any anti-inflammatory benefit gained by adding a steroid to an antibiotic, nonophthalmologists should use antimicrobial agents alone, without the addition of steroids.

Eyedrops are best dispensed in small volumes. Also, the medication should be discarded after the treatment program or the expiration date, and the drops should not be used by another person.

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Diabetic Retinopathy

DIABETIC RETINOPATHY is the second leading cause of blindness in the United States. The duration of the disease is the most important factor in determining the presence of observable retinal disease. By the age of 50 years a person with diabetes is approximately 23 times more likely to become blind than a person without this disease, and once blindness develops the average life expectancy is less than six years. Fewer than 25 percent of blind diabetic persons survive ten years.

The fundus findings in nonproliferative or "simple" diabetic retinopathy include microaneurysms, retinal hemorrhages, soft exudates (is-

chemic infarct), and hard exudates (lipid). Macular edema may develop from leaking retinal vessels and is the main cause of the loss of vision. Proliferative or "malignant" diabetic retinopathy develops if new retinal vessels (neovascularization) appear, and secondary complications of vitreous hemorrhage and retinal detachment also may lead to loss of vision.

The cause of new retinal vessels continues to be speculative, although investigation suggests that a diffusible vasoproliferative factor, produced by ischemic retina, may stimulate new vessels to develop.

Fluorescein angiography—the injection of fluorescein dye into the antecubital vein, with collection of the information on framed photographic film—plays an important role in determining the extent of fundus vascular pathology in diabetic retinopathy. Specifically, areas of vascular non-perfusion, leaking blood vessels and early retinal neovascularization can be identified.

The Diabetic Retinopathy Study (DRS) Research Group, sponsored by the National Institutes of Health, has reported an increased risk of severe loss of vision developing within two years in association with the following factors: (1) presence of vitreous or preretinal hemorrhage; (2) development of new vessels; (3) location of new vessels on or near the optic disc, and (4) severity of the neovascularization.

Light photocoagulation of the retina remains the accepted treatment for control of proliferative diabetic retinopathy when the "high-risk" factors identified by the DRS are present. Photocoagulation is also beneficial in treating some cases of vision loss due to macular disease. Fluorescein angiography data provide the basis for case selection in treatment of macular disease with laser photocoagulation. Panretinal photocoagulation may be beneficial in the control of rubeosis iridis (formation of new vessels on the surface of the iris), a condition that can lead to secondary glaucoma as a complication of diabetic retinopathy.

Nonresolving vitreous hemorrhage and traction retinal detachment involving the macula may be treated by pars plana vitrectomy, which removes blood and vitreous traction bands. Vitreous surgical procedures are usually reserved for long-standing vitreous hemorrhage; however, a national collaborative clinical trial is studying the role of such procedures in eyes with vitreous hemorrhage of shorter duration and in eyes with clear media and severe proliferative retinopathy. Vitreous op-